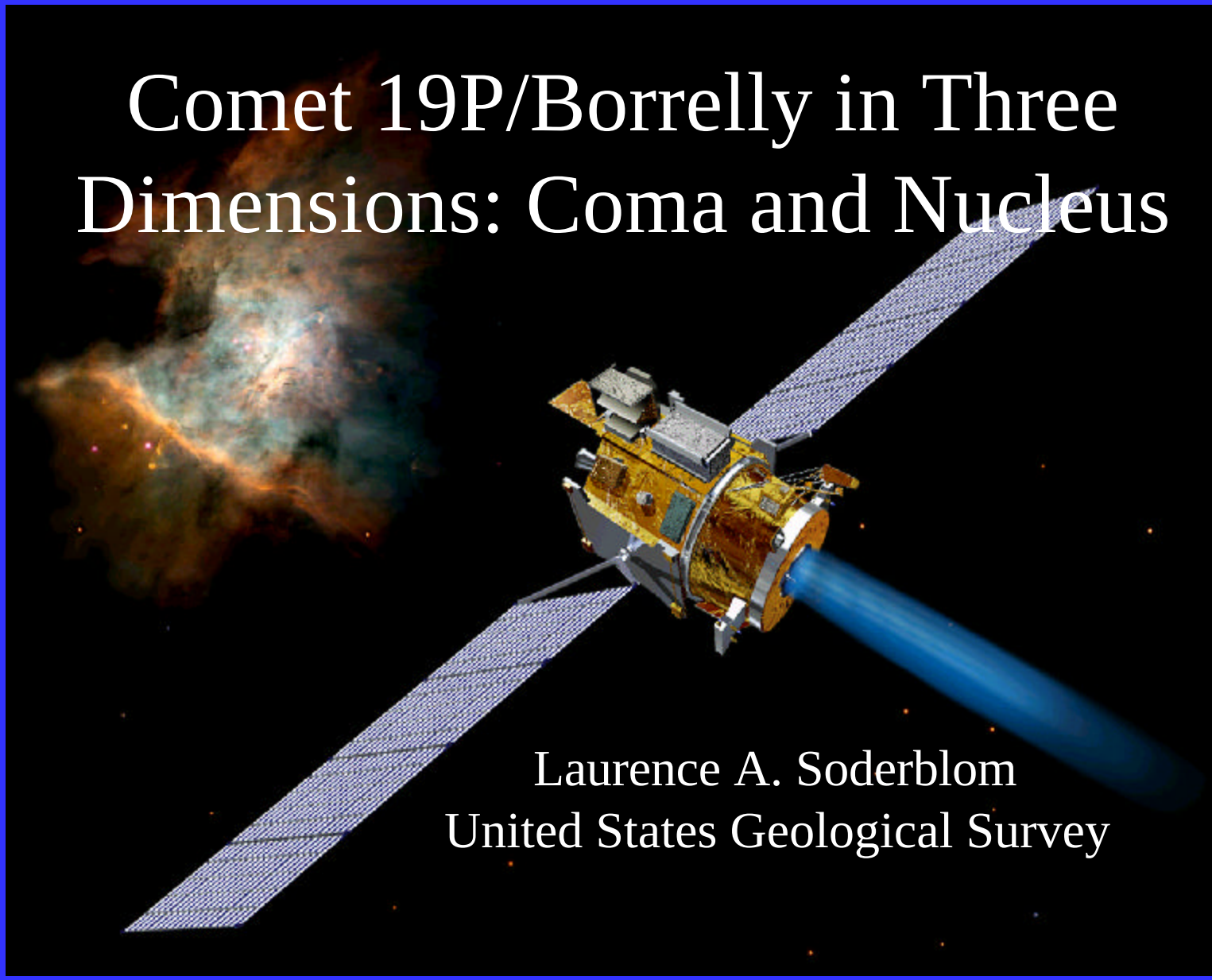
Comet 19P/Borrelly in Three Dimensions: Coma and Nucleus



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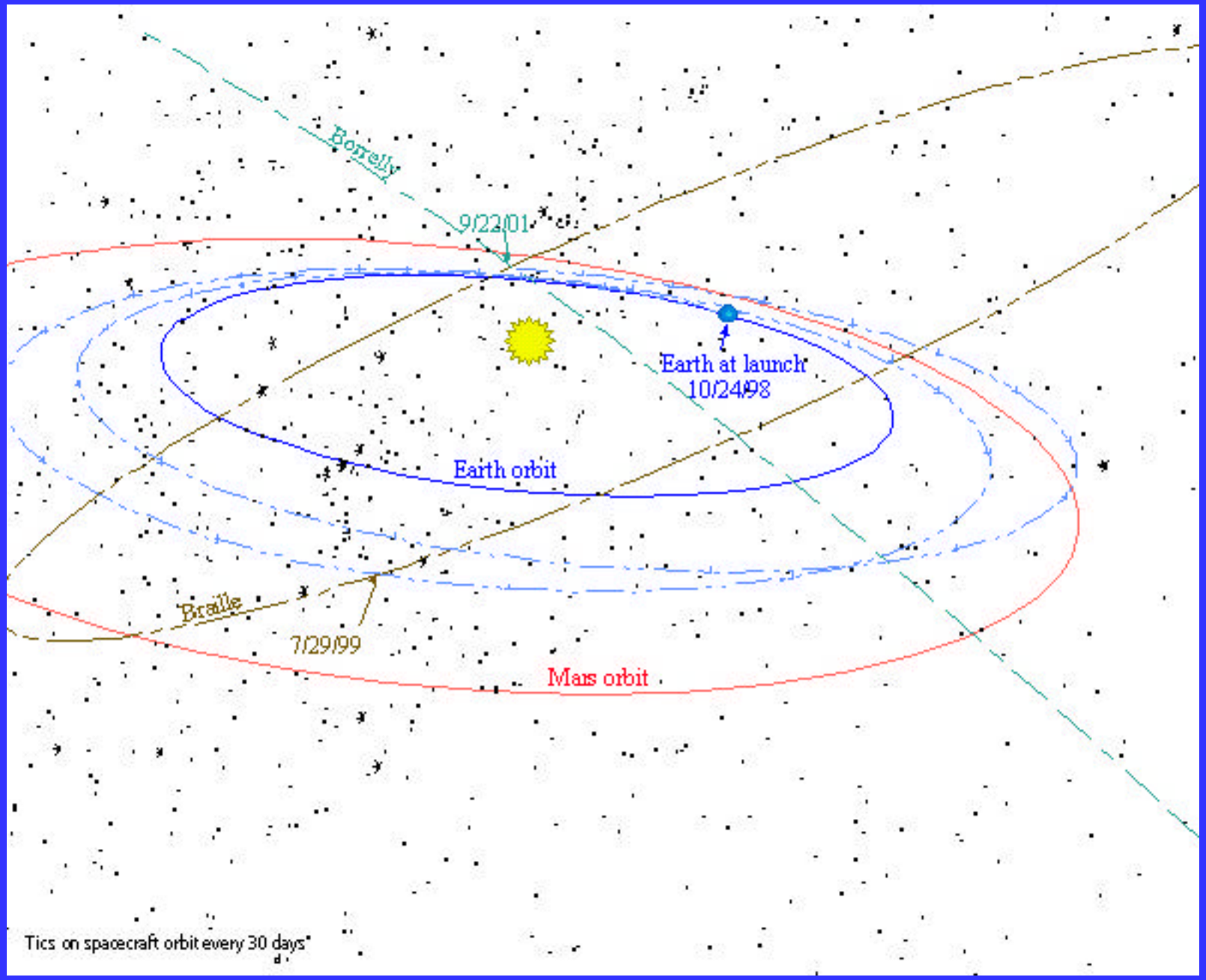
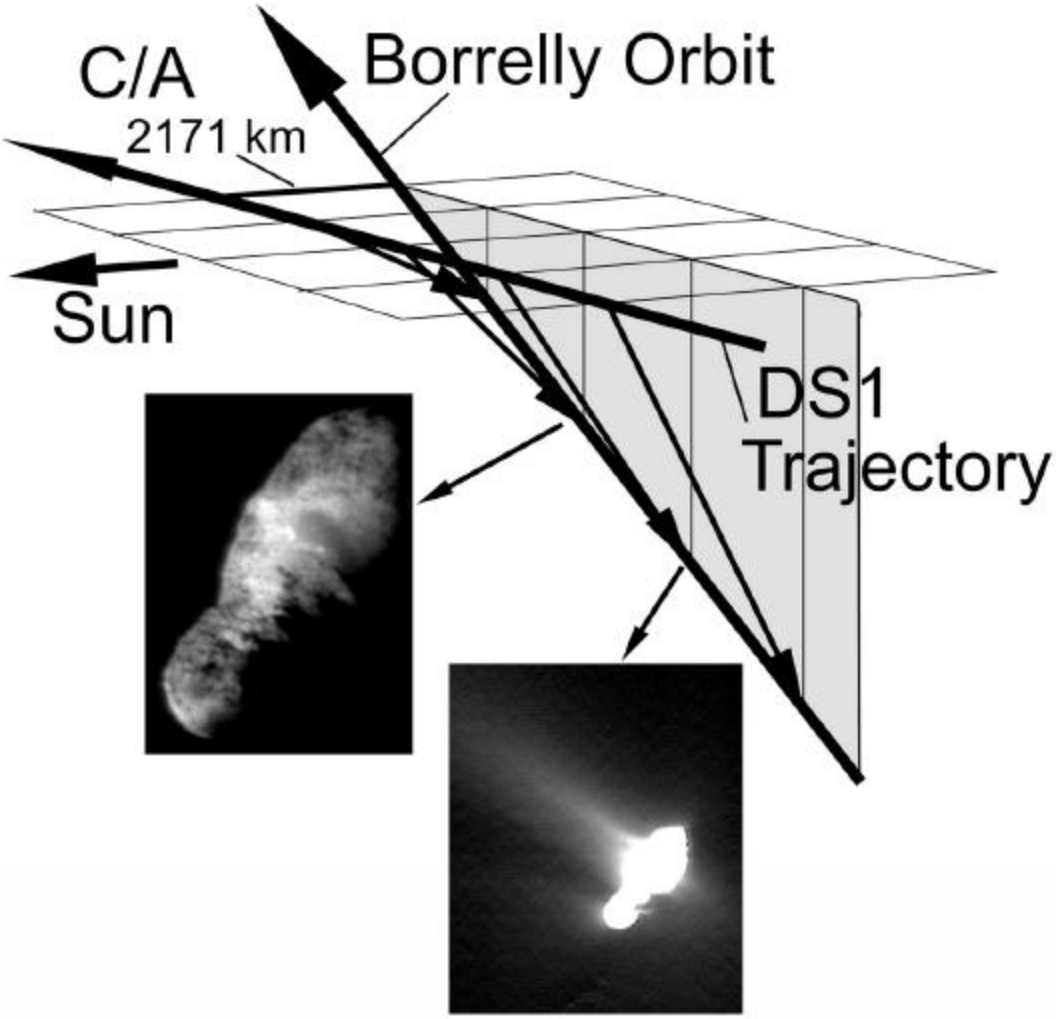
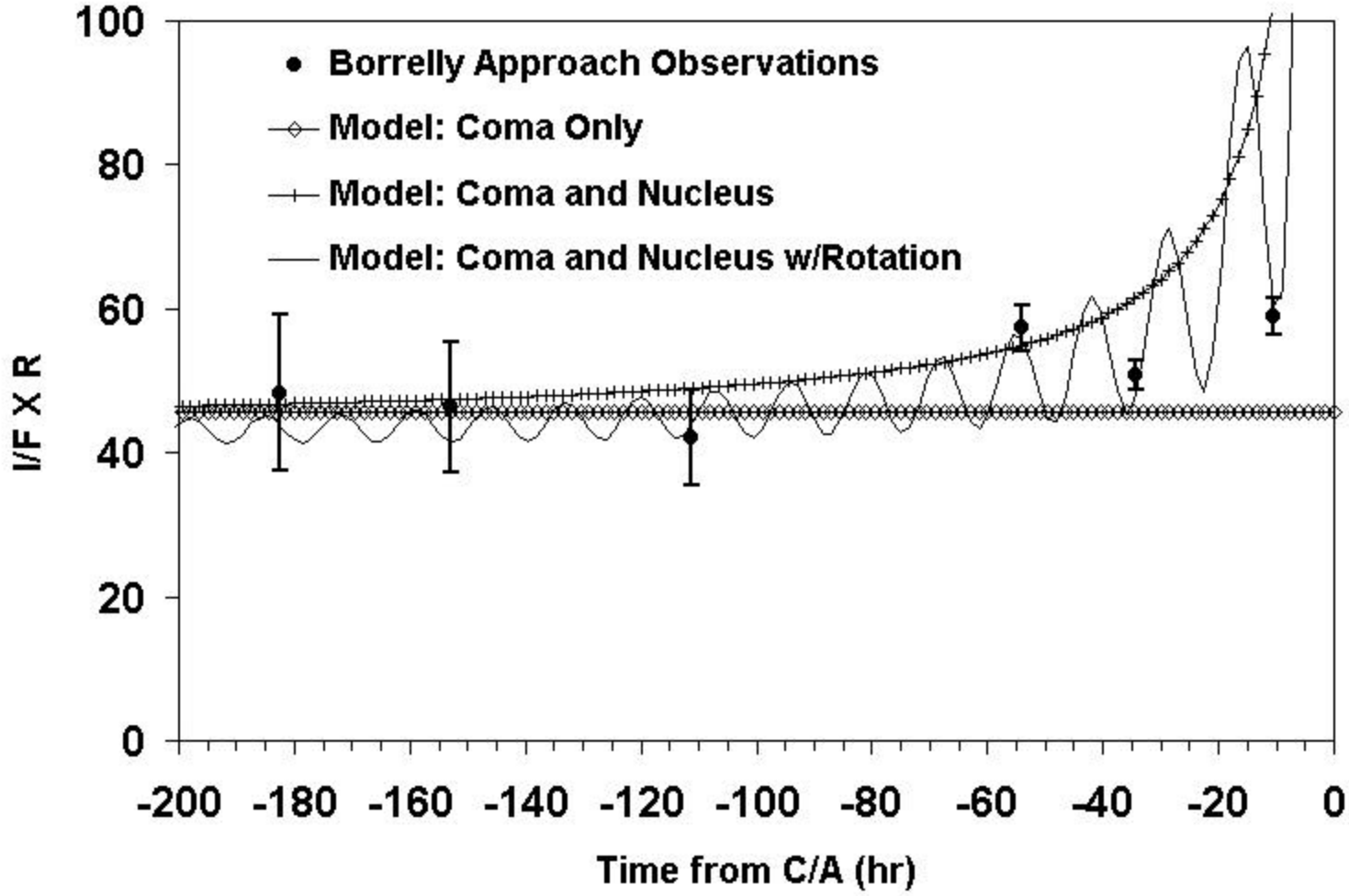
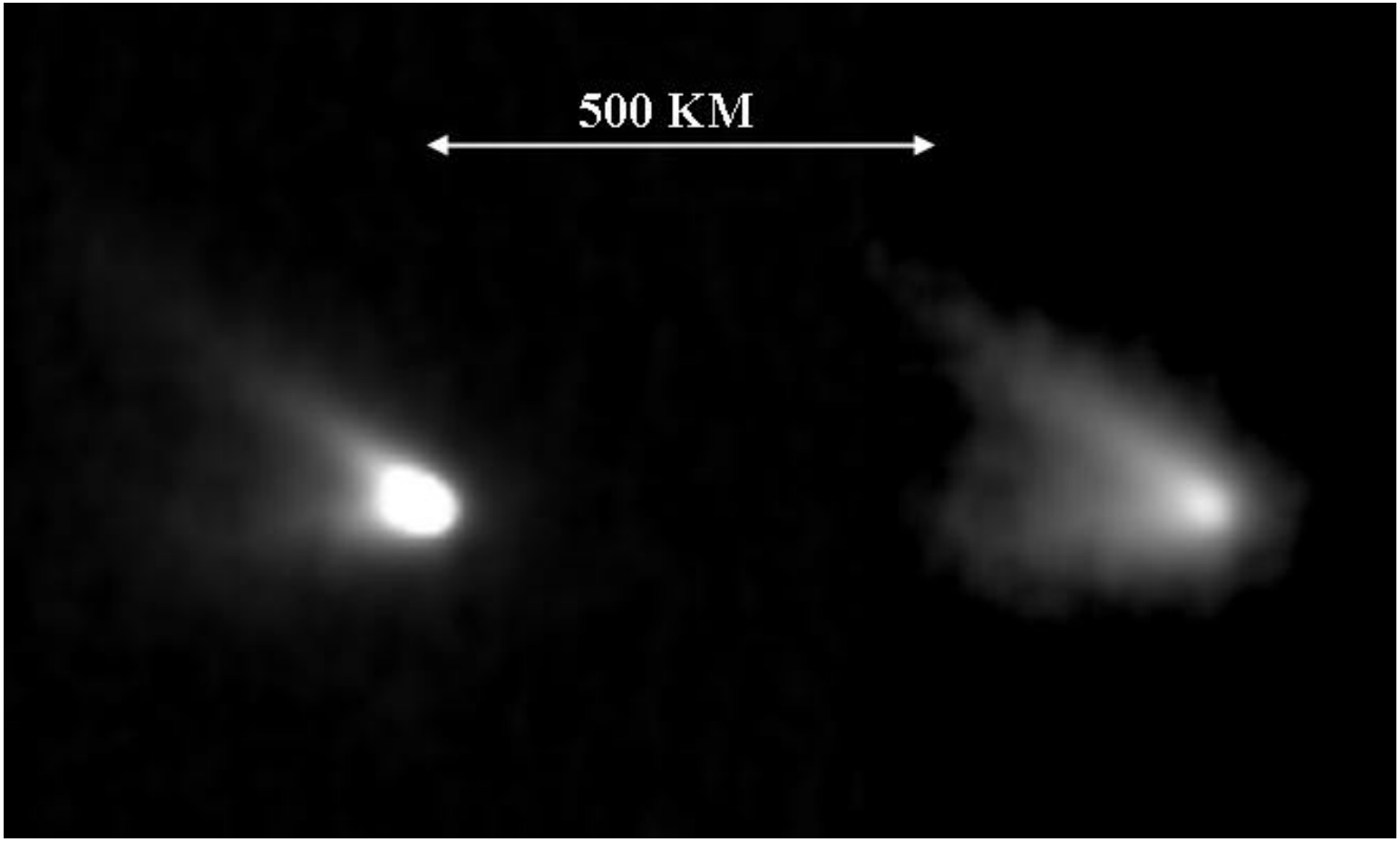
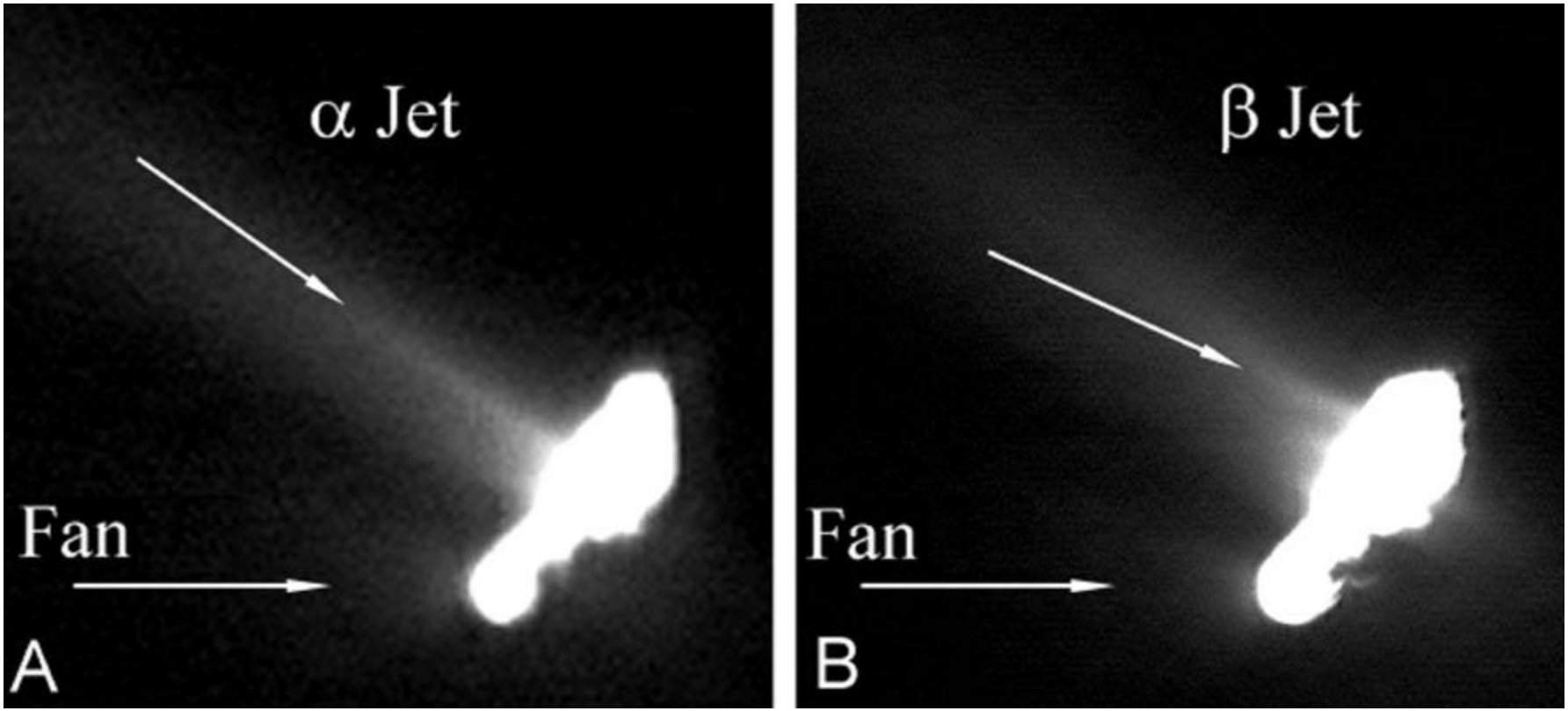
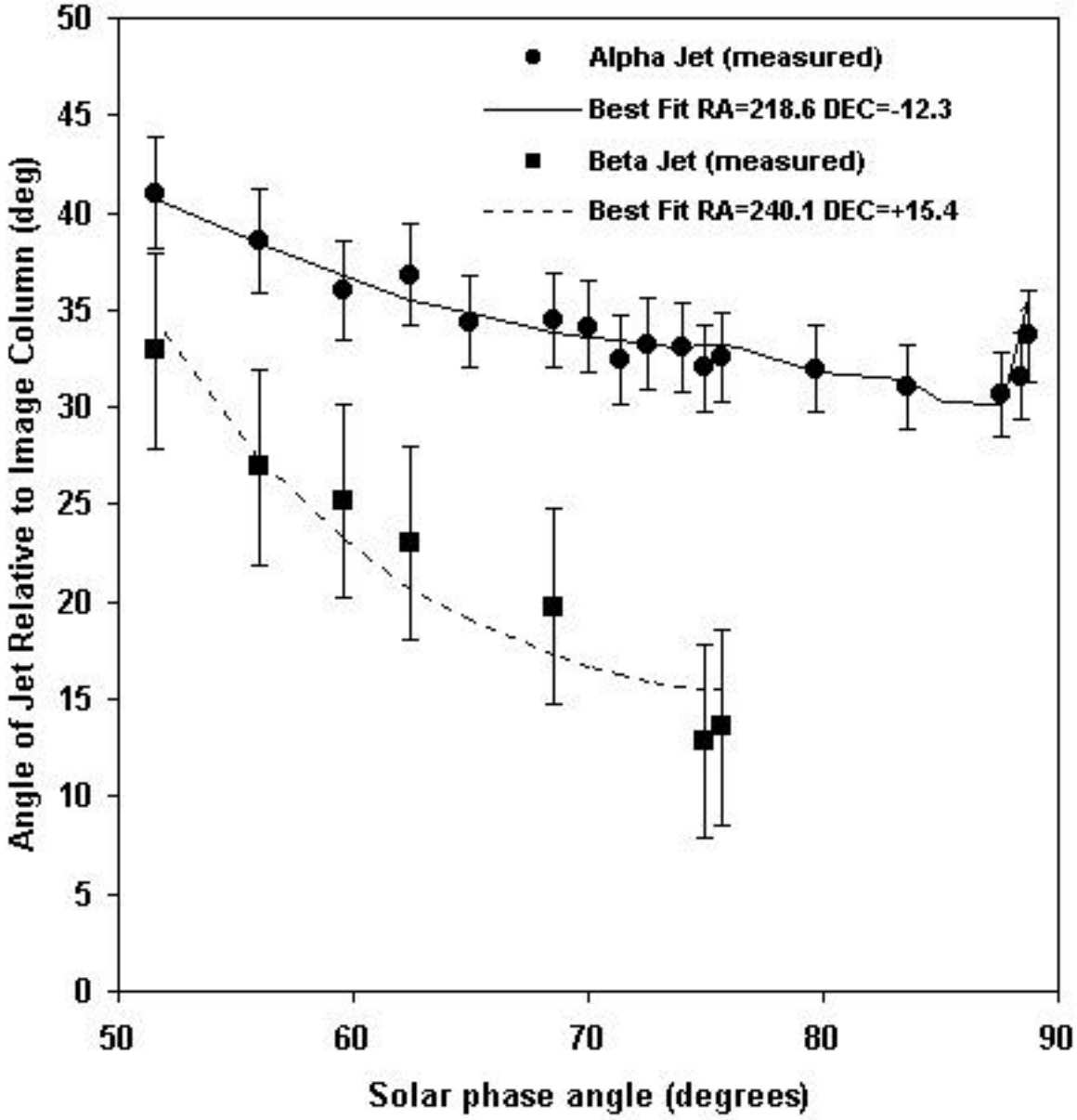

Borrelly
9/22/01
Earth at launch
10/24/98
Earth orbit
Braille
7/29/99
Mars orbit
Tics on spacecraft orbit every 30 days

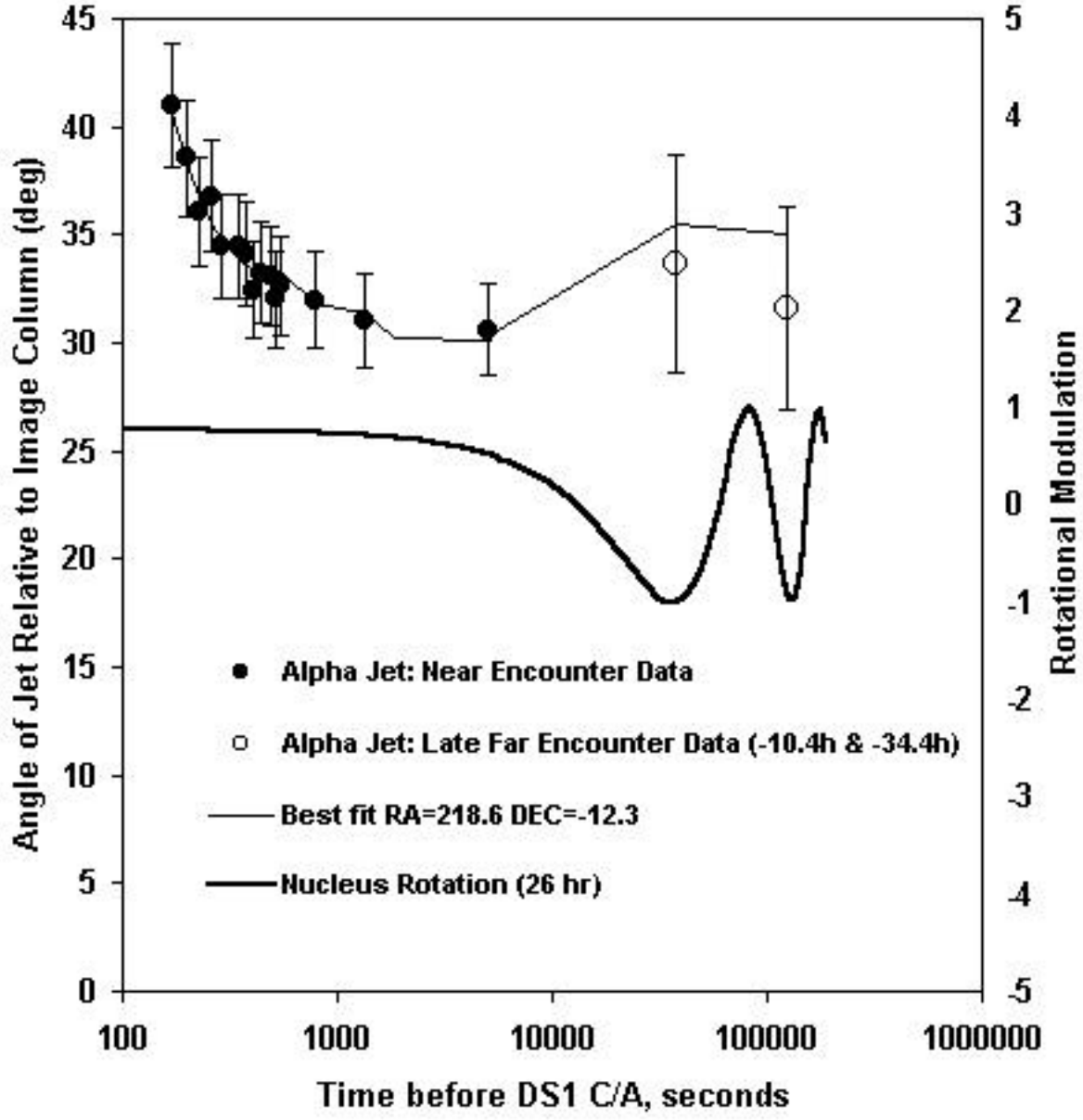

C/A
2171 km
Borrelly Orbit
Sun
DS1
Trajectory

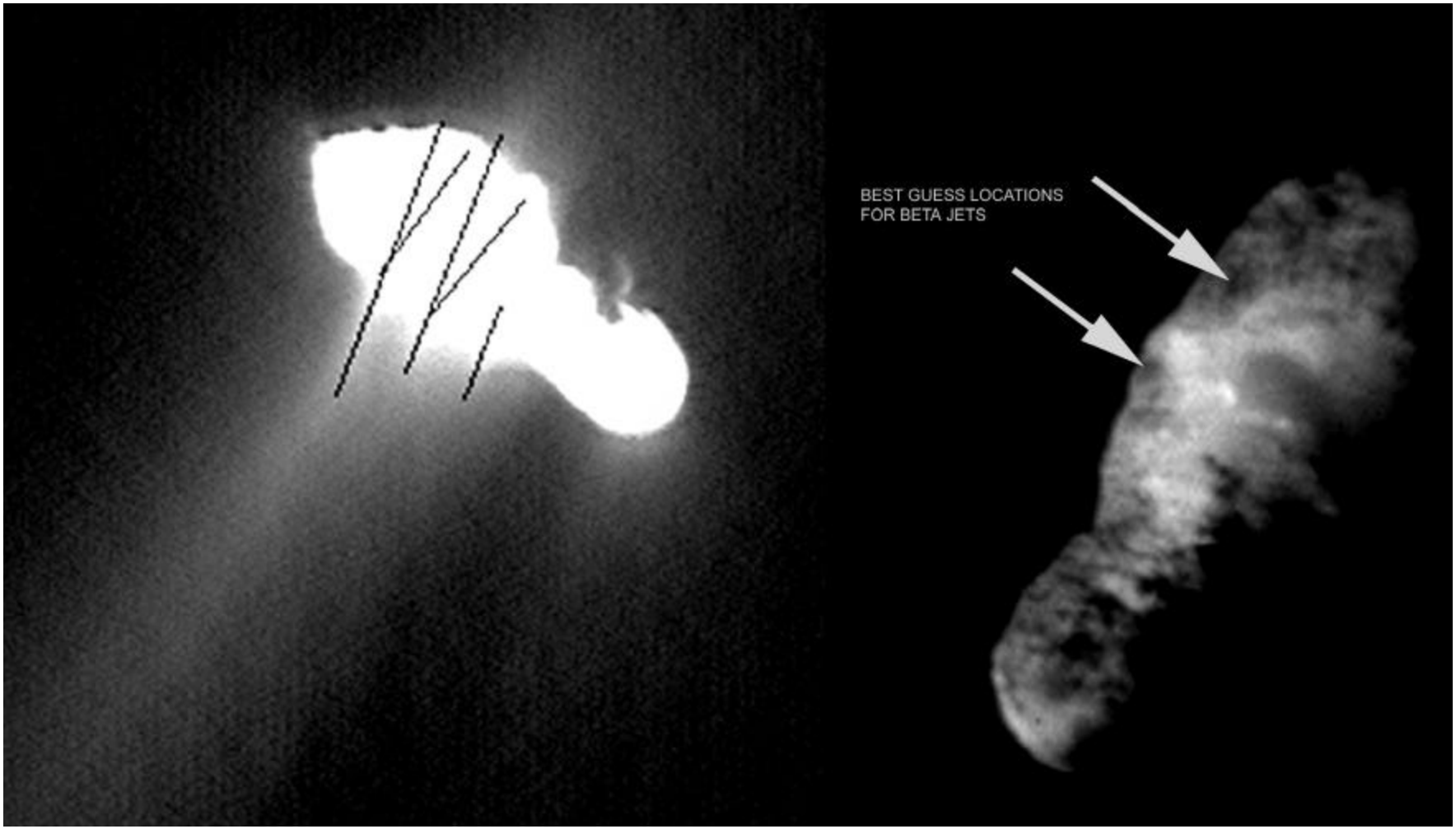

Borrelly Approach Observations
Model: Coma Only
Model: Coma and Nucleus
Model: Coma and Nucleus w/Rotation
I/F X R
100
80
60
40
20
0
-200
-180
-160
-140
-120
-100
-80
-60
-40
-20
0
Time from C/A (hr)

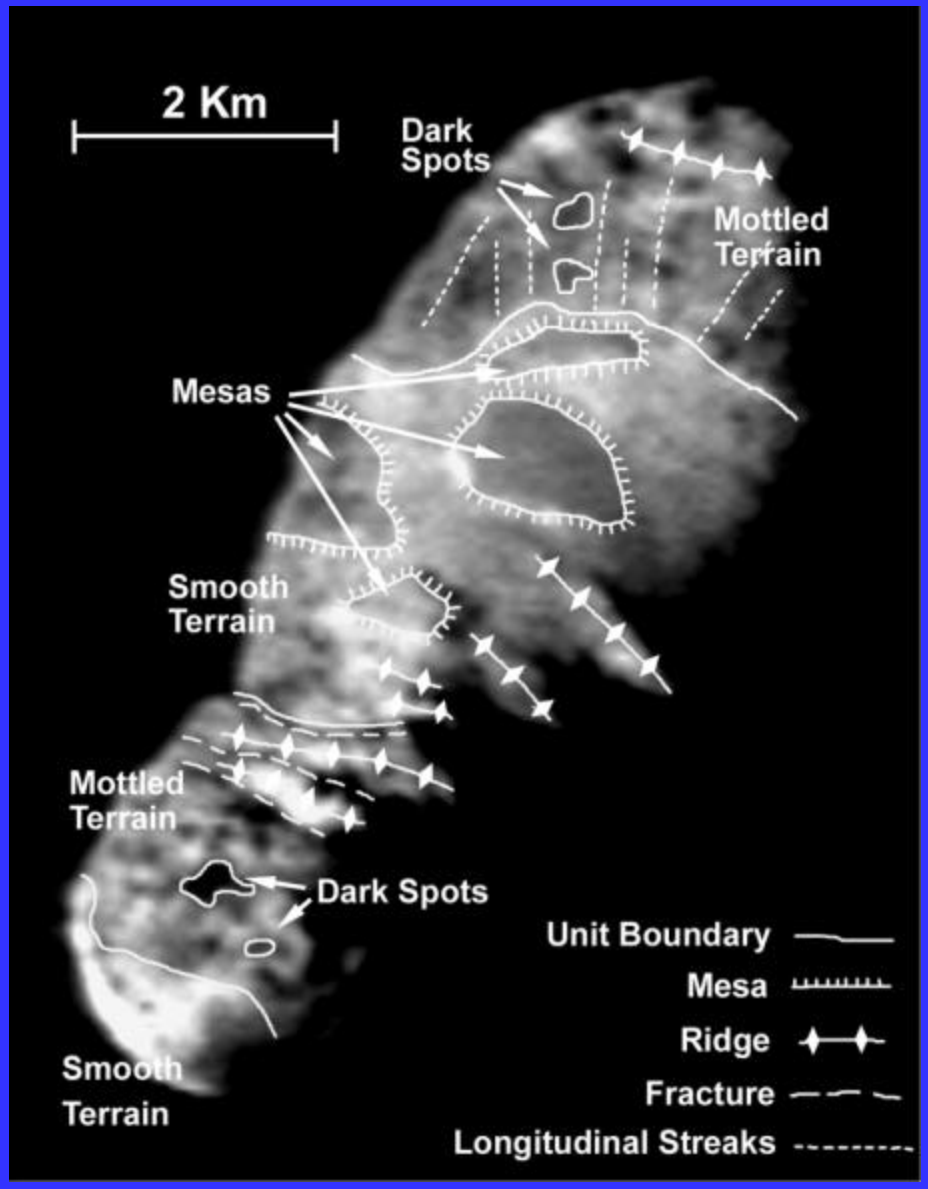

500 KM


α Jet
Fan
A
β Jet
Fan
B


Alpha Jet (measured)
Best Fit RA=218.6 DEC=-12.3
Beta Jet (measured)
Best Fit RA=240.1 DEC=+15.4
Angle of Jet Relative to Image Column (deg)
Solar phase angle (degrees)
0
5
10
15
20
25
30
35
40
45
50
50
60
70
80
90


Angle of Jet Relative to Image Column (deg)
Rotational Modulation
Time before DS1 C/A, seconds
45
40
35
30
25
20
15
10
5
0
5
4
3
2
1
0
-1
-2
-3
-4
-5
100
1000
10000
100000
1000000
Alpha Jet: Near Encounter Data
Alpha Jet: Late Far Encounter Data (-10.4h & -34.4h)
Best fit RA=218.6 DEC=-12.3
Nucleus Rotation (26 hr)


BEST GUESS LOCATIONS
FOR BETA JETS


2 Km
Dark Spots
Mottled Terrain
Mesas
Smooth Terrain
Mottled Terrain
Dark Spots
Smooth Terrain
Unit Boundary
Mesa
Ridge
Fracture
Longitudinal Streaks

Nucleus-Jet-Rotation Pole Relationship

- Main jet fixed orientation → it was on rotation axis.
- Places sub-solar latitude at ~55° N → central smooth basin, the source region of the main jet, in constant sunlight during the few months near perihelion.
- Mechanism generating highly collimated main jet is coupled to the symmetry of constant solar input
- Ecliptic Coordinates: Lat +3° Lon 220 → North Pole
- Right-handed rotation → prograde rotation
- This orientation results in very stable rotation of the nucleus around its short axis minimally affected by non-gravitational forces of the jets.